

A REPORT PREPARED FOR THE CAPE COD PLANNING
AND ECONOMIC DEVELOPMENT COMMISSION BY
SYSTEMS ANALYSIS AND RESEARCH CORPORATION,
CAMBRIDGE, MASSACHUSETTS

NORMAN A. ABEND, TRAFFIC AND TRANSPORTATION
CONSULTANT

WORKING PAPER NUMBER 6

THE TRANSPORTATION SYSTEM OF CAPE COD

PART II - HIGHWAYS

July 1969

This document is part of a comprehensive planning and economic development program being carried out in part with an Urban Planning Grant from the Department of Housing and Urban Development under the provisions of Section 701 of the Housing Act of 1954 as amended, and in part with a Planning Assistance Grant from the Economic Development Administration under the provisions of Title III of the Public Works and Economic Development Act of 1965 with the financial participation of a State Regional Planning Grant administered by the Massachusetts Department of Commerce and Development and with Barnstable County funds.

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July 17, 1969

Mr. Warrenton A. Williams, Chairman
Cape Cod Planning and Economic
Development Commission
Hyannis, Massachusetts

Dear Mr. Williams:

Transmitted herewith is a report which is an inventory and analysis of highways on Cape Cod. As part of the Cape Cod Planning and Economic Development Commission's first year planning effort, this report attempts to identify highway transportation problems. The report is primarily an inventory and evaluation of existing conditions and as such it does not contain detailed or specific recommendations for highway improvements. It does, however, provide for the first time an analysis of traffic volumes on Cape Cod which will be valuable in future transportation and land use planning.

It has also been a pleasure to work as a consultant to Systems Analysis and Research Corporation, the transportation contractor for the Cape Cod Planning and Economic Development Commission. In addition to a highly satisfactory working relationship, Systems Analysis has been generous in their efforts in assisting in the preparation of this report.

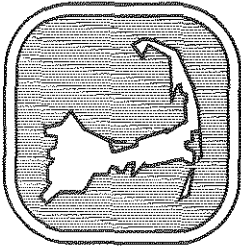
Throughout the work the most enthusiastic assistance and cooperation was provided by the staff of the Commission and by the Advisory Committee on Transportation. Their help was both encouraging and useful. It is sincerely hoped that this report will be of value to the Commission in its future planning efforts.

Respectfully submitted,

Norman A. Abend

Norman A. Abend

NAA/nt



CAPE COD PLANNING AND ECONOMIC DEVELOPMENT COMMISSION
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To The Local Municipal Officials
and Citizens of Barnstable County

This report is one of a series of studies in environmental, social, transportation, utility and economic development on Cape Cod being conducted by the Cape Cod Planning and Economic Development Commission. The study broadly surveys Cape Cod's highway system and presents a basic assessment of current traffic problems.

The report was prepared by professional consultants under the supervision and direction of, and under contract with the Cape Cod Planning and Economic Development Commission. The statements, findings and recommendations contained in the report are solely those of the consultants and do not necessarily reflect the views of the Cape Cod Planning and Economic Development Commission.

The report is being published at this time in order to make available for public discussion much useful information and data on the region's transportation facilities. It is primarily of a fact-finding nature and is intended to partially serve as the basis for the subsequent formation of policy and specific recommendation by the Commission. It is currently being reviewed and discussed by the Commission's Advisory Committee on Transportation.

The Commission is an arm of Barnstable County Government created by a special Act of the Legislature in 1965. It is composed of a member and alternate appointed by the Selectmen in each town for a term of three years and the County Commissioners. The Commission is responsible for the regional planning of physical, social and economic development activities on Cape Cod.

Warrenton A. Williams
Chairman

WAW:bc

Acknowledgements

Much of this report is based on traffic volume data made available to the Cape Cod Planning and Economic Development Commission by the Mass. Department of Public Works. In particular the Bureau of Transportation Planning and Development has been most cooperative in providing information that was requested.

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FOREWORD

A. STUDY DESCRIPTION

Highway planning for the Cape Cod region involves two separate but related tasks. One is to identify existing and near-future problems which relate to everyday traffic problems. The second is to determine, on a longer range basis, needed improvements and additions to the highway system that will permit the efficient movement of people and goods and the orderly development of the Region's land. In the past, highway planning studies were done independently from other types of regional planning. However, a new awareness of the inextricable relationship between highways and land use development now makes it mandatory (as do DOT and HUD) that highway planning be done within the context of overall regional development studies.

This report covers the highway planning studies which have been made as part of the Cape Cod Planning and Economic Development Commission's first year planning effort. As such, the report is mainly of an inventory nature and does not contain any firm recommendations for highway improvements. The data presented here represents an analysis of existing traffic conditions which has never been made for the Cape as a whole. This study points out areas where additional data is urgently needed to provide a fuller picture of traffic volumes during the critical summertime period.

Highway traffic problems on the Cape are primarily seasonal. [During the winter months one is hard-pressed to find a serious traffic problem except for occasional traffic tie-ups in the central business districts of Hyannis and Falmouth.] The situation is of course entirely different in the summer when traffic congestion does occur--in some places only occasionally, in others quite frequently and in still other places constantly throughout the two month summer season. The economic consequences of traffic congestion on the Cape are possibly less severe than they might be elsewhere. [Motorists caught in the Cape Cod summer traffic are, for the most part, recreational motorists who often do not have a specific destination.] The greatest inconvenience during the summertime is caused to year-round and summer residents who are attempting to satisfy their normal everyday business and personal needs. This is at best difficult in an area which is so heavily recreation oriented and where [summertime traffic volumes are between five and ten times greater than wintertime traffic.] There is no doubt, however, that excessive traffic can diminish the quality of the Cape Cod environment, and the pleasure of its residents and visitors. Actions must be undertaken that will control current traffic as well as channel future traffic onto facilities that are capable of handling it.

The issue of traffic raises some important questions for the Cape Cod Planning and Economic Development Commission. [Is summertime traffic congestion necessarily bad for the economy?] Should the Cape try to eliminate traffic congestion regardless of the cost both in terms of money and land displacement? Should the Cape Cod highway system be designed to experience a controlled amount of congestion during peak periods? Adoption of goals and priorities by the Commission for the Cape as a region would provide some definite guidance for individual communities in assessing their own highway and street needs and would also provide a framework of reference for state and federal agencies as they make their plans for highways and other facilities on Cape Cod. The provisions of adequate traffic

facilities is perhaps the most critical issue facing Cape Cod planners and developers. Decisions made in this area will in many cases dictate other development possibilities, potentials and limitations. Virtually everyone has agreed on the need to maintain and preserve Cape Cod's image. Not everyone is agreed however on how best to achieve this objective. Alternatives such as new roads vs. improved existing roads, the best location for boat service to the islands (more of a highway and parking problem than a boat problem) and the level of traffic service to be accommodated are policy decisions which can have a great effect upon planning for future highway improvements on Cape Cod. Direction can be given to planning efforts if there is a conscious attempt made to establish a firm regional policy.

This report deals with three basic elements of a highway inventory: traffic volumes, street capacities and functional classification. Each of these elements is treated separately in the text. Important findings are limited to the analysis of existing data and some interesting correlations which have not been made before. In addition some mention is made of three of Cape Cod's most frequently discussed long range highway proposals: the relocation of Route 6 through Eastham, Wellfleet, and Truro, the need for a third bridge over the Cape Cod Canal and increased capacity for Route 28. In all cases the discussion stops short of recommendations since they would be well beyond the scope of this study and also because sufficient data upon which to make decisions does not yet exist.

B. EXPLANATION OF SOME POSSIBLY CONFUSING TERMS

In connection with the terms "Average Daily Traffic (ADT)" and "practical capacity", some explanation is necessary. Average daily traffic is the number of vehicles using a roadway on an average day regardless of their distribution throughout the day. Although the practical capacity of a roadway is determined by the number of vehicles which can use the roadway during one hour, usually called the peak hour, it is expressed in terms of 24 hour volume which is predicated on a normal distribution of traffic throughout the day. For example, if a roadway can handle 4,500 vehicles per hour during the peak hour and the peak hour is 10 percent of the total daily traffic, then the practical capacity of that roadway would be calculated at 45,000 vehicles per day. [What happens on a number of Cape Cod highways is that the peak period instead of occurring once a day for a short period of time, as in most places, lasts from 10 a.m. to 10 p.m.]

The term "practical capacity" refers to the traffic volumes which can use a roadway at a given speed without it becoming congested (as evidenced by stop and go traffic even on a four-lane expressway). Hourly traffic volumes often exceed the "practical capacity" of a road, but the traffic conditions when this occurs are unsatisfactory.

These two elements account for the fact that the average daily traffic during the summer on a number of Cape Cod highways exceeds practical capacity. Therefore, even though the Sagamore Bridge has an ADT of about 30 percent greater than its estimated practical capacity, congestion at the bridge occurs usually only during the summertime and even then only on Friday and Sunday nights. Continuous heavy traffic from early in the morning until late at night also accounts for the fact that roads such as Route 28 in Yarmouth with a practical capacity of less than 15,000 vehicles per day occasionally handles 40,000 vehicles in one day. From a realistic point of view, a summer ADT which exceeds the practical capacity on a Cape Cod highway is not prima facie evidence that additional roadway capacity is absolutely needed.

CHAPTER I: SUMMARY OF FINDINGS AND CONCLUSIONS

Current state DPW construction programs do not include any major highway improvements on Cape Cod until at least 1976. Neither the completion of Route 6 as a four-lane expressway nor improved highway access to Woods Hole are likely to occur within the next seven years. There is interest, however, in improving conditions on the Cape. The state DPW is studying the possibility of bypassing heavily congested sections of Route 28. This approach of tackling more immediate problems first is logical. There are a number of locations where the summertime traffic volumes are causing real problems. In many cases comparatively minor traffic operations improvements could alleviate some of the nettlesome situations and many of these improvements could be accomplished at low cost and with minimum impact to existing development. Such improvements may involve the addition of traffic lanes at intersections, some new traffic signals, left-turn storage lanes where necessary and control of access in other places. This by no means exhausts the list of potential remedies. A program of this type has appeal because of its comparatively low cost and small impact on existing development.

As an initial step in producing a regional plan for highways on Cape Cod, this report has concentrated on tabulating available data and in analyzing it in order to produce some meaningful relationships. Because of fiscal limitations, the initial work did not include a detailed traffic counting program for the whole region which would have produced traffic volume data and characteristics for all of the Cape's important roads. The DPW's counting program does not include a number of roads which are of local concern. Furthermore, because DPW counts are made for statewide planning purposes, they frequently are made during off-peak periods when traffic volumes are light. There is a definite need for a comprehensive traffic counting program to cover the summer months. A proposed second year program for the Regional Planning Commission, designed to fill the void in traffic volume data has been prepared for the Commission.

Still another lack of data on the Cape is origin-destination and so-called "tourist" data that would be needed for planning long range improvements. While some effort was made in this direction by the state DPW in 1963, there is a definite need for a more current and detailed transportation study for Cape Cod including not only highways but other modes of transportation.

In summary, the next logical step for the region is to embark on a series of data collection efforts aimed at providing a firm foundation for short, medium and long range planning. Because of Cape Cod's delicate balance between natural and man-made resources, it is essential that planning studies have a foundation in fact rather than speculation. Design and funding of these studies should be an immediate goal for the Cape.

It is the summer months, when traffic is at a consistently high level 7 days a week, 12 hours a day, that set the highway capacity requirements on Cape Cod. All of the highest traffic volumes of the year occur during the summertime. The so-called 30th, 50th and even 100th highest traffic volume hours, frequently used as a basis for determining the capacity requirements of improved roadways, all occur during the summer. The 50th highest hour, for example, theoretically represents the 1 hour each week (on the average) when traffic volumes reach their peak. The 100th highest hours of the year would presumably occur on the average of twice a week. On Cape Cod, however, whether the 30th, 50th or 100th highest hour is used, these almost always occur during July and August, frequently during a period of a few weeks. The combination of unusually good weather, vacation schedules and promotional activity can easily produce days during which 10 of the highest hours occur consecutively.

This discussion of the Cape's traffic pattern has one significant ramification in terms of traffic volume figures on Cape Cod. Average annual daily traffic (AADT) data for the Cape and even individual day or weekly counts often do not give an accurate picture of conditions which exist for most of the summer. *conf.* Until recently, because of the complexities of computer programming, average daily traffic figures on the Cape were computed by the DPW using the same formulae as for other parts of the state. *DPW is wrong* As a result the AADT figures for most Cape Cod highway meant very little in terms of trying to ascertain the degree of summertime traffic congestion. Under any conditions, AADT figures for Cape Cod highways have limited value since even in locations where there is serious traffic congestion throughout the summer, AADT volumes are significantly less than the existing capacity. In this report summertime average daily traffic (SADT) has been used in showing traffic volumes on the Cape and in computing highway capacity-volume ratios. AADT values are useful, however, in providing an indication of the gross magnitude of traffic volumes on a road.

Even with this caveat in mind there are other problems in trying to get an accurate traffic volume picture of Cape Cod highways. As most Cape Codders are aware, there are a variety of factors in the summertime which have a distinct impact on traffic volume. "Changeover day" when people are leaving or occupying rented facilities taxes *changeover day* Route 6 capacity and also affects the shopping pattern on Cape Cod, creating heavy traffic volumes when they would otherwise not be expected.

Weather is of course a major factor which affects traffic volumes. However the effect is not uniform throughout the Cape and has a different effect upon different elements of the population. A hot sunny day produces heavy beach traffic while shopping, *weather* tourist and sightseeing activities drop off. A partly cloudy or cool day when the beaches are not so attractive produces lighter volumes on beach access roads while creating heavier traffic volumes in town centers and on routes where there are concentrations of tourist shops. A rainy day has a depressing effect throughout the region.

Weather related to day of the week is another variable. A hot weekday will generally produce moderate traffic volumes on the entire Cape as people flock to and stay at the beaches as long as possible. On the other hand, a hot weekend day can produce a large influx of day-trippers streaming out of the nearby metropolitan areas to Cape Cod for *day trippers* some relief from the heat. The day-trippers have a greater impact on the upper Cape and mid Cape traffic volumes and less of an impact on the lower Cape.

Events of the 1940's and early 1950's, particularly the phenomenal growth of private automobile ownership (from 1946 until 1960, national automobile registrations doubled) drastically changed the traffic picture on Cape Cod. Increased ownership of automobiles also created pressure for the construction of new highways. As a result of more and better automobiles and highways, the mileage range of recreational travellers increased significantly while the time distance remained relatively constant. It formerly took as long to get from Boston to Nantasket as it now takes to get from Boston to Hyannis. Furthermore, overcrowding at recreational facilities closer to major metropolitan areas resulted in a lengthening of recreational trips even on a time basis. The result of these changes has been to put Cape Cod well within the day-trip range of several metropolitan areas and within easy weekend range of the New York metropolitan area. (The opening of the Jamestown Bridge makes New York nearly an hour closer to Cape Cod.) During this transition period the superior characteristics of automobile travel for recreation trips has seriously affected public transportation. Rail travel to the Cape has been eliminated as has steamship travel from Boston to Provincetown. Boat travel is now more closely associated with purely recreational rather than transportation use. Aviation has become an important mode for weekend commuters from Boston and New York. Bus travel between Boston and Hyannis has seen moderate growth, in contrast to a national decline in inter-city bus travel.

*
autos
doubled
from
1946-
1960

In following the trend of Cape Cod traffic volumes, 1951 must be the beginning point since traffic volume counts before then were not made on any systematic or regular basis. In fact, traffic data prior to 1951 has been difficult to find simply because traffic volumes were not significant and additionally because continuous traffic data collection and analysis programs were just beginning. This is true not only for Cape Cod but for other parts of the state and country as well. Even if pre-war data from the 1930's were available, it would have limited value in a current analysis. While on a percentage basis the increases prior to 1951 might have been large, the traffic volumes prior to the 1950's created little if any traffic problem on the Cape.

1951:
traffic
condition
roughly
same

Since 1951, however, traffic volume data has been collected on a regular basis by the State Department of Public Works. One gap in current data is traffic volumes on short streets, which lead from the major highways of the region to town centers, beaches and other traffic generators. For the most part these volumes are not needed by the DPW in their statewide traffic analyses and, except for occasional counts for specific purposes, data is not available.

Traffic volumes on the Cape have been growing at a much more rapid rate than the rest of the state. During the 1950's when traffic volume growth in the state was as high as 5 percent per year and during the 1960's when traffic was growing at a more "normal" 3 to 4 percent per year, traffic volumes on the Cape grew at more than double the state rate. On the average, traffic volumes on Cape Cod's highways grew by two and a half times during the fifteen year period from 1951 to 1966. This represented an annual growth rate of about 15 percent. Between 1951 and 1962 traffic volumes doubled. Table 1 shows the traffic volumes across four screen lines on Cape Cod. These figures represent the traffic volumes on major highways crossing these screen lines which run from one side of the Cape to the other. (see Map 2). The greatest growth has occurred in the middle Cape area (screen lines 2 and 3) where traffic has grown by a factor of 2.5 to 2.7 times. Traffic growth in the lower Cape has been slightly less, while at the Cape Cod Canal bridges traffic

*

growth has been less than that experienced in the middle Cape area. This can be accounted for by the fact that the middle Cape, particularly the Hyannis-Yarmouth area is beginning to develop a fuller year-round economy than other parts of the Cape. Thus, the factors for screen lines one and four are more representative of the growth in tourist traffic while the traffic growth at screen lines two and three represent the incremental growth due to increased year-round activities in addition to tourist traffic growth.

The lower Cape stands out not only in terms of its lower overall traffic volumes but in terms of its lower rate of growth. Somewhere between the Dennis town line and the Wellfleet town line, the traffic pattern changes from a mixture of tourist and year-round traffic to one which is predominantly tourist oriented. Based on visible economic activities, it is estimated that Chatham and the remainder of the Cape below Brewster constitute the area where a tourist traffic pattern prevails. West of these communities the traffic pattern includes a growing element of year-round activity. *year-round activity outside Chatham*

TABLE 1: ANNUAL AVERAGE DAILY TRAFFIC
AT SELECTED SCREEN LINES
1951 to 1966, Barnstable County, Massachusetts

	Cape Cod Canal ¹	Barnstable ² West Town Line	Dennis ³ East Town Line	Wellfleet- Eastham ⁴ Town Line	Total
1951	12,000 (EST)	6,383	7,984	2,389	28,756
1955	16,869	8,953	10,600	3,400	39,822
1960	23,390	11,260	12,370	2,610	49,630
1962	28,441	14,247	10,765	4,499	57,952
1964	31,275	16,930	17,277	5,053	70,535
1966	26,940	17,880	20,300	5,850	70,970
Growth 1951-1966	2.3	2.7	2.5	2.4	2.5

Notes:

¹Map 2 locations A and B

²Map 2 locations G, H, and I

³Map 2 locations M, L, and Q

⁴Map 2 location X

Source: Massachusetts Department of Public Works, Traffic Counts

Resource Inventory & Analysis
TRANSPORTATION

TRAFFIC COUNT AND SCREEN LINE LOCATIONS

Legend

- Traffic Counts
- Screen Line



Consultants

DESIGN - SCIENCE INTERNATIONAL, Cambridge and Concord, Massachusetts
Environmental Planning, Design and Development Consultants
METCALF & EDDY, Boston, Massachusetts
Engineering Consultants
SYSTEMS ANALYSIS & RESEARCH CORPORATION, Cambridge, Massachusetts
Economic and Transportation Consultants

Mapmaking source / supplied by the Massachusetts Department of Public Works.
Mapmaking source / National Highway Map, Department of the Commonwealth of Massachusetts, prepared by Lockwood, Kiewit & Isidori, Inc., 1966.

Map references (U.S.G.S. Quadrangle Series) updated from other source maps and aerial photography taken April and May, 1966. Field inventory taken July, 1966. Massachusetts State Plane Coordinate System (NAD 83) shown as solid grid at 10,000 foot intervals. Roads designated as private by local authorities are not shown.

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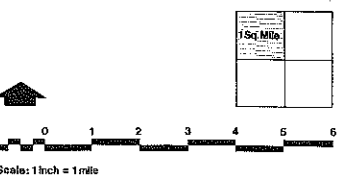


Table 2 shows traffic volumes at a variety of selected locations over a 15 year period from 1951 to 1966. The Table provides a broad picture of traffic increases at various points on Cape Cod's highway system. An overall traffic increase is clearly evident even though at any particular location the variation from year to year may seem odd. The Table provides evidence that there are dangers in attempting to use specific traffic volume data for one location at one point in time. Annual traffic volume figures are often based on short counting periods and are factored to compensate for month of the year and day of the week. These expansion factors vary widely on the Cape and if average daily traffic (ADT) figures are used they should be used with caution and with an understanding of their derivation.

An example of the wide variation in Cape Cod expansion factors is the difference in seasonal variation between Route 6 in Barnstable and Route 6 at the Wellfleet-Eastham town line. At the Barnstable recorder (a permanent station counted continuously throughout the year and located about two miles east of the Sandwich town line), the ratio between the lowest monthly volume and the highest monthly volume is less than 5 times (see Table 3). At the Wellfleet recorder however (a major control station counted one week per month), the average traffic during August is 8 times as great as the average traffic during January. Other roads may have more or less variation depending upon their location. For example, in Hyannis, it is estimated that the summertime traffic volumes are only twice as much as wintertime traffic on downtown streets. (Street capacity plays a part in keeping the summertime volume low.) At the other end of the scale, on roads which lead to beaches and serve summertime uses only, summertime traffic may very easily be 10 to 20 times more than wintertime traffic.

C. MONTHLY VARIATION

Traffic volumes on the major highway system on the Cape are changing in two ways. The most significant change has been the steady rise in overall traffic volumes described in the preceeding section. Average daily traffic is increasing both during the summertime and in the wintertime. A second trend which is discernible from the traffic volume analysis is a slow but gradual change in the variation of monthly average daily traffic. While the summertime traffic during July and August continues to grow at a brisk rate, the summertime period is becoming less of a peak period. For the last several years, the months of July and August have shown a gradual decline as a percentage of the annual average daily traffic (AADT). This trend results from the fact that traffic during the off-peak months is increasing at a greater rate than during the summer months.

Although some Cape Cod enthusiasts are quick to point out that Cape Cod is rapidly becoming a year-round resort location, traffic volume figures over the past several years indicate that this trend is quite moderate. Chart 1 shows monthly traffic factors for the Barnstable recorder over a twelve year period from 1956 to 1968. When each month is plotted, the pattern becomes evident. The months of July and August show a consistent downward trend in terms of their relationship to the annual average daily traffic. This has occurred while summertime traffic volumes have been increasing. However, summertime increases have been off-set by even faster growth during the off-peak season. March, April and May have experienced the greatest off-peak rate of growth. Wintertime traffic volumes in January and February, however, have shown

TABLE 2: ANNUAL AVERAGE DAILY TRAFFIC
SELECTED LOCATIONS
1951 to 1966, Barnstable County, Massachusetts

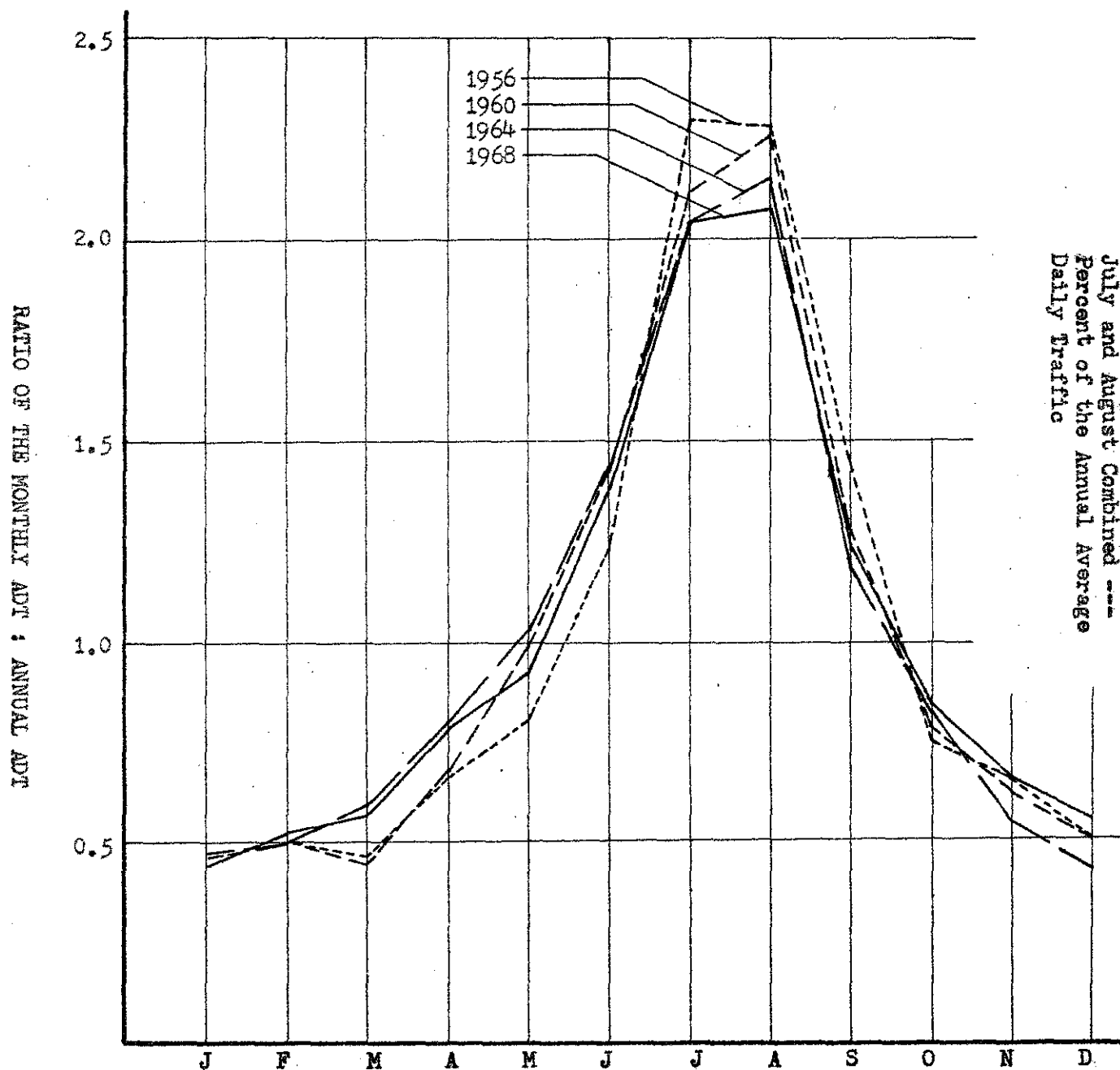
Map Location	1951	1955	1958	1960	1962	1964	1966
A	-	8,500	10,710	11,440	13,775	18,779	14,840*
B	-	8,369	12,220	11,950	14,666	12,496	12,106*
C	5,169	6,200	5,120	5,240	4,762	-	9,400**
D	1,373	2,000	3,000	1,970	1,433**	2,137**	1,800*/**
E	4,379	4,480	-	2,190	1,983**	2,138**	5,100*/**
F	2,867	3,000	4,200	6,950	6,964	7,356	-
G	2,514	3,620	-	-	-	-	5,000*
H	471	1,200	-	1,360	1,027	1,322	1,600*
I	1,393	800	2,100	1,560	1,369	1,764	1,700*
J	3,021	7,500	7,000	-	-	-	11,600**
K	2,005	600	760	-	-	-	-
L	1,445	3,000	-	2,390	-	-	1,700*
M	6,549	4,600	5,500	6,330	3,665	9,587	10,200*/**
N	2,476	4,533	-	-	8,878	10,666	11,480
O	8,172	6,500	-	5,210	-	-	7,500
P	4,249	5,650	6,500	3,650	5,954	7,184	10,000*
Q	-	4,000	-	7,810	-	-	6,800
R	-	2,200	-	1,570	1,756	1,800	2,200*
S	-	1,900	-	520	400	500	1,400*
T	2,838	3,720	-	-	-	-	1,900
U	2,993	2,600	4,700	5,820	5,980	7,595	-
V	-	1,900	1,410	2,500	1,127**	-	1,500
W	-	5,000	4,000	3,530	1,875	4,400	2,700
X	2,389	3,400	-	2,610	4,499	5,053	5,850
Y	2,011	2,200	2,320	-	-	4,200	4,100*
Z	-	1,650	1,710	2,490	3,992	-	2,900*
AA	0	700	800	2,600	-	-	1,800
BB	1,997	5,000	-	2,380	1,704	1,200	1,400
CC	4,700	6,500	4,400	3,530	-	-	-
DD	0	0	4,570	6,660	5,710	10,224	11,760
EE	5,075	5,700	8,000	6,200	6,487	7,566	7,500*

* 1965 data

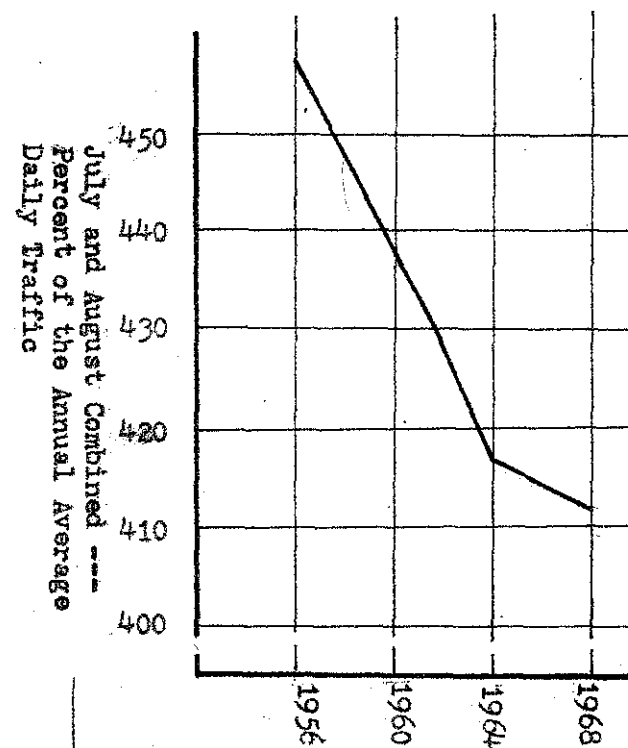
** Figure represents different location of count but estimated to represent original location.

Source: Massachusetts Department of Public Works

CHART 1 MONTHLY TRAFFIC VARIATION AT THE BARNSTABLE RECORDER, 1956--1968



July and August as a
Percent of the Annual
Average Daily Traffic



Source: Massachusetts Department of Public Works, Traffic Counts

little growth either in total volumes or in percentage of the annual average daily traffic. During the fall, September and October have also been growing as a percentage of the AADT although the rate of growth has been less than during the spring months. One reason for this may be that September and October have always been popular months for Cape Cod off-peak visitors.

Because weather plays such an important role in the Cape Cod traffic picture, it is possible that some of the variation in Chart 2 results from stretches of good or bad weather. The data suggests that the effect of weather is less significant during July and August than during off-peak periods. Thus while the July-August and the January-February trends are clear, the spring and fall months show more variation. One explanation for this might be that summer-time activities are frequently planned in advance by persons whose vacation schedule fixes the time and length of their stay. It is unlikely that a visitor from the midwest or the middle Atlantic states would cancel a visit on the basis of a weather forecast predicting dismal weather for a day or two, especially when the planned length of stay may be a week or longer. On the other hand, during the spring or fall, when tourist activity on the Cape is for the most part limited to the weekends, poor weather, either existing or forecast, could have a greater effect in reducing weekend traffic volumes. This occurs because weekend trips are made by persons who live closer to the Cape and who can make the trip without spending an inordinate amount of time on the road.

In summary, this reasoning indicates that winter and summertime traffic volume growth is more predictable while weekend travel during the spring and fall is subject to wider variation.

Table 3 shows the monthly ADT for the Barnstable recorder for 1968. The last three columns provide factors that have been used in this report to relate the various monthly ADT's to the annual ADT. The ratio of 4.85:1 between summertime and January traffic is an average figure for the Cape. Data from the lower Cape would provide a wider variation while downtown Hyannis and Falmouth show a smaller variation between summer and winter.

Table 4 shows the variations in weekday, Saturday and Sunday traffic volumes in 1968. While the monthly ADT, a combination of all days during the month, ranges between 6,000 vehicles per day in January to 29,300 vehicles per day in August, there is a much wider variation in average daily traffic in the figures for weekdays, Saturdays and Sundays. Traffic volumes range between the low of a January weekday with an ADT of 5,600 to an average Saturday in July with a daily traffic of 39,200. Neither of these volumes, however, is suitable as a basis for projecting highway needs. The monthly average daily traffic during July and August is a more reasonable and realistic value upon which to predicate traffic needs. Based on Table 4, there are 60 days per year (July and August) when traffic volumes at the Barnstable recorder average 29,000 vehicles per day. The table provides a comparison between weekday and weekend traffic through the year. An average Saturday during July and August experiences about 20 or 30 percent more traffic than the average daily traffic for the month. Surprisingly, even during the spring and fall, weekend traffic also ranges between 20 and 30 percent above the monthly ADT. Only during the seasonal ebb of December, January and February is weekend traffic less of a factor. Weekend traffic in relation to weekday traffic also shows a fairly consistent pattern for most of the year. From March through October, weekend traffic generally averages between 30 and 40 percent greater than weekday traffic.

TABLE 3: MONTHLY VARIATION -- BARNSTABLE RECORDER
1968- Route 6, 2.5 MILES EAST OF SANDWICH TOWN LINE, BARNSTABLE COUNTY
MASSACHUSETTS

Month	Eastbound	Westbound	Total	Factor to get AADT	Percentage the MADT is of the Annual ADT	Ratio of Monthly ADT to Summer ADT (July-Aug. = 1.0)
January	2,987	3,002	5,989	2.33	43	4.85
February	3,502	3,727	7,229	1.93	42	4.02
March	4,007	3,924	7,931	1.76	57	3.61
April	5,522	5,525	11,047	1.26	79	2.60
May	6,631	6,241	12,872	1.08	93	2.23
June	9,895	9,401	19,296	.72	139	1.48
July	14,231	14,451	28,682	.49	204	1.0
August	14,262	15,046	29,308	.48	208	1.0
September	7,837	9,155	16,992	.82	122	1.69
October	5,713	5,834	11,547	1.21	83	2.49
November	4,614	4,428	9,042	1.55	65	3.20
December	3,806	3,826	7,632	1.83	55	3.77
TOTAL	83,007	84,554	167,561	÷ (12)	=	13,963 AADT

Source of Data: Massachusetts Department of Public Works Traffic Counts

TABLE 4: VARIATIONS IN WEEKDAY, SATURDAY AND SUNDAY TRAFFIC VOLUMES,
BY MONTHS IN 1968 -- BARNSTABLE RECORDER, BARNSTABLE COUNTY
MASSACHUSETTS

MONTH	MONTHLY ADT	AVG. WEEKDAY	AVG. SATURDAY	AVG. SUNDAY
January	6,000	5,600	7,500	6,400
February	7,200	6,800	7,500	8,900
March	7,900	7,000	9,600	11,100
April	11,000	9,600	13,400	16,000
May	12,900	11,300	15,400	18,300
June	19,300	16,000	26,000	28,800
July	28,700	25,400	39,200	34,700
August	29,300	26,800	37,700	33,700
September	17,000	15,100	19,300	24,300
October	11,500	10,100	13,900	16,400
November	9,000	8,500	10,700	9,900
December	7,600	7,600	7,500	8,200

SEASON KINZBERG

Source of Data: Massachusetts Department of Public Works Traffic Counts

During the winter months, however, the variation is not as great. (Both of these factors are to some extent related.) The significance of these figures is that they provide some basic relationships which are useful in projecting future highway needs in addition to their potential use for other purposes. Thus, traffic volumes on an average Saturday or Sunday can normally be expected to be between 30 and 40 percent greater than traffic during the week--at any time of the year except the dead of winter. This means that monthly ADT, weekly ADT or weekend ADT are all valid for projection purposes since a uniform relationship exists between them. Chart 2 shows the various ADT's plotted on a monthly basis for 1968. This figure graphically shows the uniform pattern of the relationship. The lines identifying monthly, weekday, Saturday and Sunday traffic volumes do not cross over each other except Saturdays in July and August. The variation during the winter is a little vague but this is not when traffic is a problem.

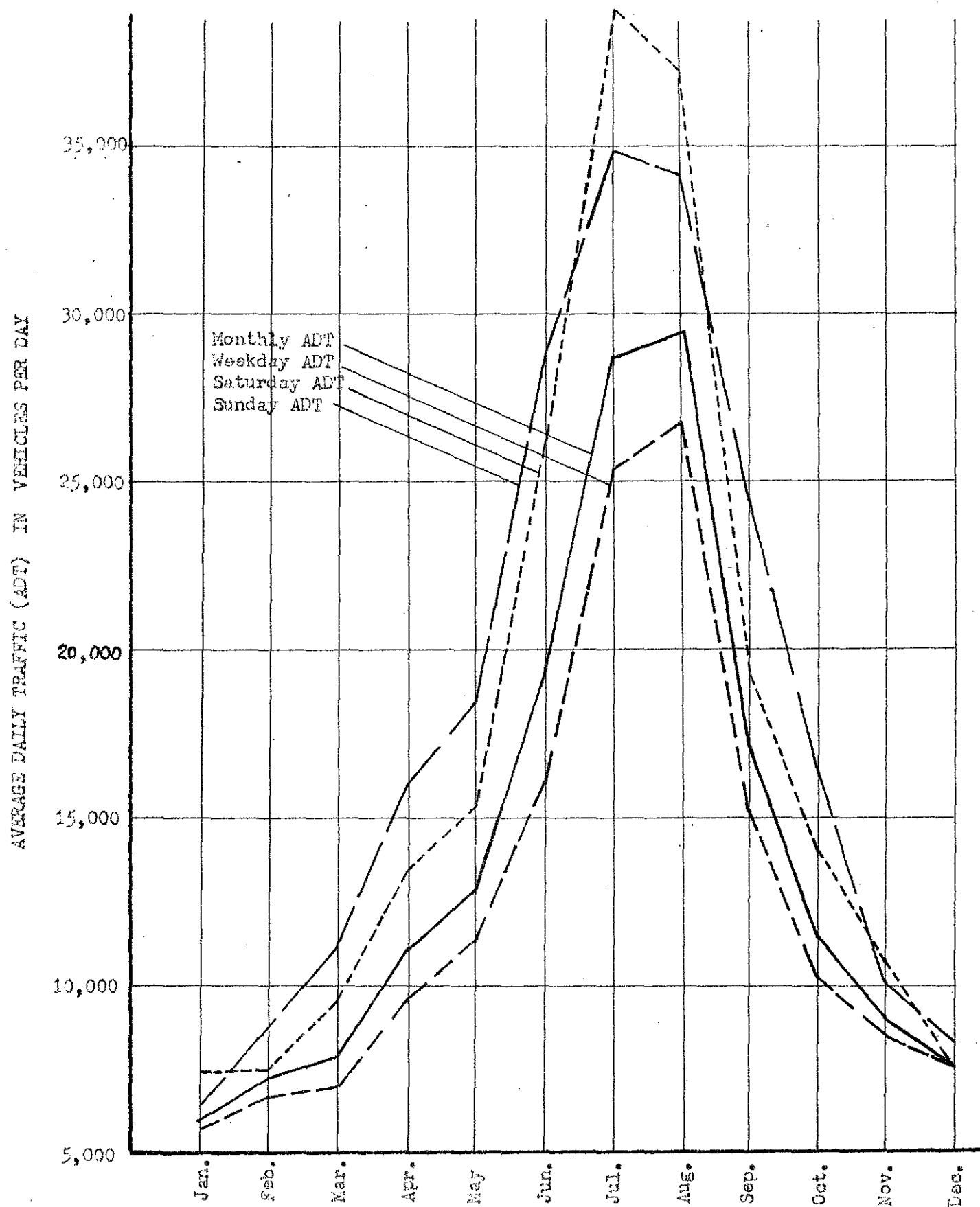
The perennial Cape Cod debate of whether July or August produces the heaviest traffic volumes is not resolved by traffic volume data. Table 4 shows that in all categories, July and August seem to produce about equal traffic volumes. Other traffic counts corroborate this fact. While there is some variation between these two months, it is not large enough to say that there is a significant difference in traffic volumes during the two month summer season. One pattern which shows in Table 4 is that weekend traffic during July is heavier than weekend traffic during August while the reverse is true for weekday traffic. However, the differences in total volumes are so small that these variations are not significant in terms of planning.

In summary, the data in this section points out that traffic volumes on Cape Cod have a definite seasonal, monthly and daily pattern which can be predicted with a fair degree of reliability. This does not mean, however, that the relationships observed at the Barnstable recorder are applicable at all locations on Cape Cod. The Barnstable recorder on Route 6 is the only permanent recorder on Cape Cod where traffic is counted continually 365 days per year. Route 6 serves a variety of traffic types including industrial, commercial and recreational trips. The ratio between summer and winter traffic is higher on routes which serve primarily summer homes which are vacant during the winter. At the other end of the scale, parts of the Cape have traffic volumes which do not vary as much as the Barnstable recorder. Nevertheless, the Barnstable recorder does present a good picture of traffic variation on the Cape--on the average.

D. VOLUME - CAPACITY RATIOS

For identifying highways with traffic problems, the ratio between the existing traffic volume and the capacity of a roadway provides a good yardstick for measuring the seriousness of the problem. Traffic volumes alone do not give the complete picture. A roadway which carries a heavy volume of traffic may not be congested because its capacity is high. Other roadways may carry a much smaller volume but because of limited capacity are frequently congested. A volume-capacity ratio provides some basis for determining the need for traffic improvement since it states the relationship between the traffic volume and the capacity of a roadway. Map 3 shows the 1968 summer ADT on Cape Cod's major highways and also shows the volume-capacity ratios for Cape Cod's major highway system. The data on roadway capacity

CHART 2 1968 AVERAGE DAILY TRAFFIC AT THE BARNSTABLE RECORDER



Source: Massachusetts Department of Public Works, Traffic Counts

have been taken from the Massachusetts Department of Public Works' statewide highway inventory study. The traffic volumes have also been obtained from the Mass. DPW and have been factored to represent estimated summertime average daily traffic. The map provides a graphic impression of where Cape Cod's highway trouble spots are or will be in the near future. The problem areas are those roadways where the volume is more than 70 percent of the estimated capacity. It is an indication that the section of roadway is already experiencing difficulties or will be experiencing problems in the near future. For example, everyone is aware of the fact that Route 28 in Yarmouth is congested during the summertime (the volume-capacity ratio is greater than 1.0), however, a portion of Route 6A in Brewster where the volume-capacity ratio is about 70 percent represents a potential trouble spot because existing summertime traffic volumes are approaching capacity.

Route 28 immediately north and east of Falmouth is already experiencing difficulties to a point where the State Department of Public Works is now studying ways of improving the situation here. In Bourne, there is a short section of Route 6A west of the junction of Route 130 which is also going to experience traffic difficulty in the near future.

Probably the most critical traffic problem existing on the Cape today is Route 28 ^{04e.28} ~~beginning at the airport rotary in Hyannis and extending eastward through Yarmouth, Dennis and Harwich.~~ The concentration of year-round and seasonal homes and tourist facilities along the route itself are not duplicated elsewhere on the Cape. Traffic volumes on this section have reached 40,000 vehicles per day resulting in almost continuous congestion from early in the morning until late at night. Route 134 south of Route 6 which serves this area shows up as a potential trouble spot although it is not badly congested yet.

Route 28 in Chatham between Harwich and Orleans is also in trouble but to a much lesser extent than the portion of Route 28 to the west. It might be noted that Route 28 in Hyannis and Yarmouth is beginning to experience congestion even during the off-peak times of the year. This is in large measure due to the increasing level of year-round economic activity in the area.

Route 28 in Chatham, however, has significantly less commercial development and the density of year-round and summertime housing served by the route is less than in communities to the west. In addition the road system of Chatham makes it much easier to bypass Route 28 if it is congested. Geographically Chatham is off to one side of the major flow of Cape Cod traffic and is not impacted by a combination of heavy local and through traffic. Traffic tie-ups in the central business district are completely a function of auto sightseers.

Route 6 between the Eastham rotary and the intersection of Route 6A in Truro is not usually congested although there are a number of locations on the route in Eastham and Wellfleet where occasional traffic stoppages and backup occur. Traffic volumes on this section of road have not reached the point where congestion is a regular, everyday occurrence even though the traffic volumes are high, especially in Eastham. Along this section of roadway the moderate density of residential development and the limited number of commercial establishments permits satisfactory operating speeds about 35-45 miles per hour despite the heavy traffic volume. As a result of the high volumes and high speeds, the roadway has a greater potential for serious traffic accidents than most other sections of roadway on Cape Cod. ^{Eastham side}

Until such time that major improvements are made, it would be extremely valuable if a systematic improvement of traffic operations along this section of roadway were to be made. For example, in North Eastham near the intersection of Nauset Road, the cross section of Route 6 changes from two lanes northbound to one lane northbound at the intersection. As a result northbound traffic must make a transition from two lanes to one lane; however the situation is compounded by northbound vehicles turning left toward residences on the Bay. Continuation of the four lane cross section northward a few hundred feet would eliminate this particular problem at a low cost. There are other locations where minor traffic engineering improvements could increase roadway capacity as well as safety. Even if the road is bypassed in the future, these improvements would continue to be useful.

In addition to these sections of main road on the Cape, there are a number of other localities which experience almost daily congestion in the summertime. These are the central areas of Provincetown, Orleans, Chatham, Hyannis, Falmouth and Woods Hole. In the case of Provincetown, Orleans and Chatham, it is doubtful whether any effort should be made to improve the situation. The reason for this is that the congestion is due almost entirely to tourists who are sightseeing from their automobile windows. Each of these central areas are quite small in total area and are perhaps best viewed from a walking position; nevertheless, streets in these towns are congested. One reason is that motorists are not in a rush to get anywhere and are in fact interested in spending the time stopped in traffic looking around. That none of these areas has a conflict between through traffic and local traffic is an important factor. Except for a few destinations, there is no need for motorists to travel through downtown Provincetown, Orleans or Chatham. In view of this kind of situation, it would be impractical to consider elaborate schemes aimed at increasing roadway capacity so that additional vehicles can be handled. It is highly unlikely that the attractiveness of these towns to tourist vehicles would be improved by significantly reducing traffic congestion in them.

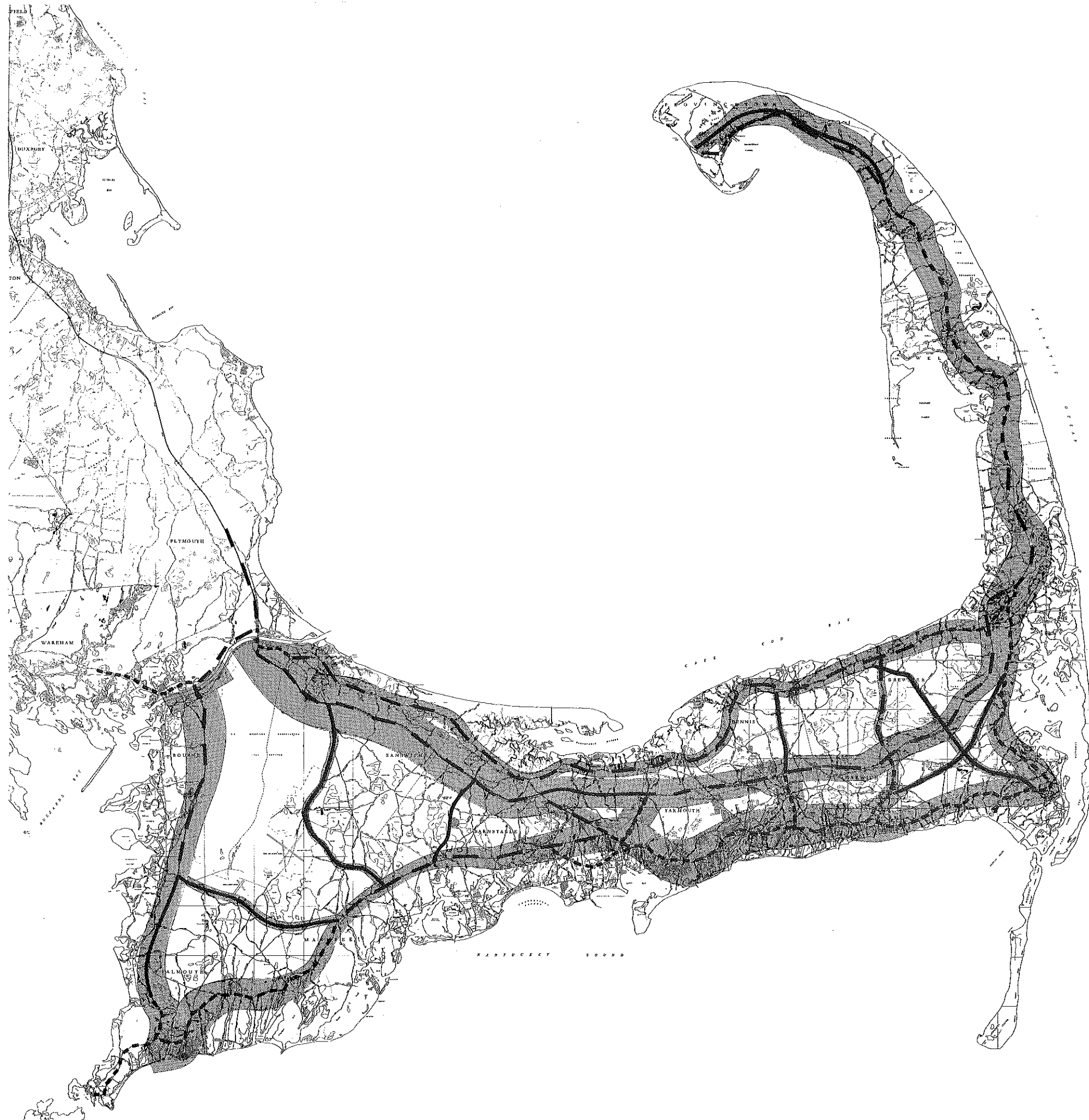
In the case of Hyannis and Falmouth the situation is somewhat different. Both communities, particularly Hyannis, have a year-round economy and therefore have to keep traffic moving. Unfortunately in both cases summertime traffic must pass through the town in order to reach major destinations. It is impossible to get to the Hyannis waterfront and some nearby beaches without going through the downtown areas. It is equally difficult to get to Woods Hole and the ferries without going through Falmouth. In these cases consideration should be given to improving access to the summertime traffic generators so that relief is provided to city streets in order for basic economic activities to continue functioning.

In this regard the proposal of the Steamship Authority to provide service out of Hyannis will have a negative impact on traffic in the central business district of Hyannis. Unless provisions are made to improve vehicular access from Route 28 and less north of the central business district to the waterfront, the additional traffic generated by the Steamship Authority activities will only serve to further deteriorate traffic conditions in the center during the summer. The Steamship Authority activities are also a key to traffic problems in Falmouth and Woods Hole where a solution to both traffic and parking problems is vital.

Some important traffic improvements have been proposed for Hyannis in connection with its comprehensive planning activities several years ago and in connection with recent planning for the town center. These improvements appear necessary if the town is to maintain the momentum of its year-round economic base growth.

In the case of Woods Hole, there is distinct conflict between tourists interested in sightseeing and tourists and residents wishing to use the Steamship Authority facilities. The latter group is interested only in the fastest trip to the dock and a place to park once there. The solution to any traffic problems in this area must be directly tied to improvement of the parking situation for the boat service. Use of an abandoned railroad right-of-way, increased parking facilities both in Woods Hole and Falmouth must all be considered in a solution to the problem here. *Woods Hole*

In addition to the roads analyzed in Map 3, there are other short sections of road on the Cape particularly serving beaches which are congested in the summertime. The lack of data on summertime traffic volumes is one reason why they have not been depicted on this map. In addition, they do not represent segments of a continuous through route system and are therefore not as critical to the overall situation on Cape Cod although they may cause local problems.



Cape Cod

3

Resource Inventory & Analysis TRANSPORTATION

VOLUME-CAPACITY RATIOS and 1969 SUMMER A.D.T.

Legend

- Less Than 0.3
- 0.3 - 0.7
- Over 0.7

1" = 40,000 veh./day
1968 Summer A.D.T.

Norman Brown
7/1/80
Comm. for D. H. Thibault
V. H. 1000000

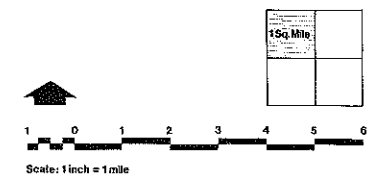
Consultants

DESIGN - SCIENCE INTERNATIONAL, Cambridge and Concord, Massachusetts
Environmental Planning, Design and Development Consultants
OPTICAL & EBY, Boston, Massachusetts
Engineering Consultants
SYSTEMS ANALYSIS & RESEARCH CORPORATION, Cambridge, Massachusetts
Economics and Transportation Consultants

Mapwork source: 1. "General Highway Map, Barnstable County, The Commonwealth of Massachusetts," prepared by Lockwood, Keister & Bartlett, Inc. 1965.

Map reference: F.H.S.G.S. Quadrangle sheets updated from other source maps and aerial photography taken April and May, 1969. Aerial inventory taken July, 1969. Massachusetts State Plane Coordinate System. Distances shown on grid at 10, 500 foot intervals. Roads designated as private by local authorities are not shown.

"This document is part of a comprehensive planning and economic development program being carried out in part with an Urban Planning Grant from the Department of Housing and Urban Development under the provisions of Section 701 of the Housing Act of 1964, as amended, and in part with a Planning Assistance Grant from the Economic Development Administration under the provisions of Title 17 of the Public Works and Economic Development Act of 1965 with the financial participation of a State Regional Planning Grant administered by the Massachusetts Department of Commerce and Development and with Barnstable County funds."



MAPING PROGRAM AND GRAPHICS BY DESIGN - SCIENCE INTERNATIONAL

III: STREET CLASSIFICATION

A. GENERAL

The functional classification of a highway system is an important step in planning the need for new streets and highways and also permits an orderly and logical capital improvements program to be made. It is also used as a basis for establishing design standards. In addition to the use of function as a classification criterion, another classification uses the criterion of administrative jurisdiction. There is some relationship between functional classification and administrative classification, especially at the upper and lower levels of classification. For example, expressways which are at the top, functionally, are usually the responsibility of state highway agencies while at the bottom, local access roads which serve only abutting property are normally the responsibility of the local community.

Functional classification refers to the designation of street systems according to their traffic function, i.e. does the road serve through traffic or local traffic. The purpose of a functional classification is to identify those roadways which are in need of physical upgrading in order to carry the type of traffic which is expected to use the road. Functional classification is tied into roadway design. Higher echelon roads have higher levels of design and usually more lanes while local roadways are nearly always two lanes with minimum pavement widths.

Administrative classification is usually not dealt with in planning studies because these studies usually are not concerned with assigning agency responsibility for the construction or reconstruction of specific roads. Planners feel that the existing or potential use of the roadway has little to do with which public agency maintains that roadway. The reason for raising the question of administrative classification at this time is that the State Department of Public Works is in the process of completing a major statewide highway study which contains among its major recommendations an administrative reclassification of all roads in the Commonwealth. The study proposed among other things the establishment of a continuous, interconnected state highway system in place of the hodge-podge of roads which now constitutes the state highway "system." The state report has recommended an increase in the mileage of state highways in order to produce a fully contiguous highway system administered by the State Department of Public Works. One major characteristic associated with state highways is that they are eligible for federal aid. At the present time roads on the federal aid primary and federal aid secondary systems receive 50 percent federal aid for reconstruction and new construction. The difference between primary and secondary roadways whether they are called federal aid primary, state primary, federal aid secondary or state secondary is minor in terms of federal support. To the region, the most important factor in addition to funding of state highways is that if a road is designated as a state highway, the local communities and the county lose jurisdiction over the road in terms of having a key voice in how, when, and if roadway improvements are made.

In this section of the report, there will first be a discussion of the functional classification of Cape Cod's highways followed by a summary of the State Department of Public Works' proposal for an administrative classification which to a large degree follows the functional classification and assigns responsibility for different

types of roadways. In order for the proposed administrative classification to become effective, the DPW's proposed classification must be approved by the state legislature which will then fix the administrative responsibilities for all roads in the state. This will require that legislation be filed and that there be an ironing out of any differences between the state DPW and individual communities. While most communities would welcome DPW assistance (and along with it, federal support) for needed highway improvements, the state DPW in looking at statewide needs is apt to subordinate local requirements particularly in regard to new land takings for widening and relocation. On the other hand, if a roadway is part of the local road system, it is strictly the responsibility of the community to plan, design and construct the roadway. In these cases only local considerations must be weighed.

Regardless of functional or administrative classification, one other system, perhaps most familiar to the state's residents, will remain almost intact. This is the route numbering of highways which has little relationship to the administrative responsibility for different sections of highways. For example, a vehicle traveling on a numbered route in Massachusetts might be traveling at various points on local, federal aid secondary or federal aid primary roads.

B. FUNCTIONAL CLASSIFICATION

Despite a wide variety of terminology, there are essentially four basic types of streets and highways which serve an area. These are:

- 1) expressways
- 2) major arterials
- 3) minor arterials and collectors
- 4) local access streets

Map 4 shows the functional classification of highways on Cape Cod. Each of the major functional categories used on the map are described below:

Expressways - These highways serve traffic which contains a high proportion of through or long-distance trips. Such roadways carry interregional traffic onto and through the Cape to major focal points and usually provide no access to abutting properties. Traffic can enter and leave the highway only at interchanges. On Cape Cod there are two roads which serve these functions and should meet these standards. These are Route 6 from the Sagamore Bridge to the tip of Provincetown and Route 28 from the Bourne Bridge to Woods Hole. There is enough traffic headed for these terminal points to justify the construction of four-lane divided highways along the entire length of these routes. Some of this traffic comes directly from off-Cape origins but much of the summertime volume is generated on the Cape. Plans are currently being made for the completion of Route 6 as an expressway facility from the Canal to Provincetown but at the moment there are no proposals for extending Route 28 to Woods Hole as an expressway facility. Route 28 south of the Bourne Bridge is reasonably well designed to serve its function. However, as the road approaches Falmouth and Woods Hole the present roadway becomes congested because of its narrowness and the mixture of both local and through traffic that must share the roadway. Since it will be extremely difficult if not impossible to extend Route 28 through Falmouth to Woods Hole as an expressway, some provision should be made for improvements that will provide service for through traffic destined for Woods Hole.



Resource Inventory & Analysis TRANSPORTATION

FUNCTIONAL HIGHWAY CLASSIFICATION

Legend

- Expressways
- Major Arterials
- Minor Arterials

Consultants

DESIGN - SCIENCE INTERNATIONAL, Cambridge and Concord, Massachusetts
Environmental Planning, Design and Development Consultants
METCALF & EMDY, Boston, Massachusetts
Engineering Consultants
SYSTEMS ANALYSIS & RESEARCH CORPORATION, Cambridge, Massachusetts
Economics and Transportation Consultants

Base map source: / supplied by the Massachusetts Department of Public Works.
Base map source: / "General Highway Map, Barnstable County, The Commonwealth of Massachusetts," prepared by Lockwood, Knobel & Bartlett, Inc. 1955.

Map references: U.S. G.S. Quadrangle Sheets updated from other source maps and aerial photography taken April and May, 1985. Field surveys taken July, 1985. Massachusetts State Plane Coordinate System (MSPCS) shown as solid grid at 10,000 foot intervals. Roads designated as private by local authorities are not shown.

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Scale: 1 inch = 1 mile

Major Arterials - This system should consist of roads which connect the major population centers and other important traffic generators. It is important that this system provides continuity of roadways of reasonably high design standards so that traffic can maintain operating speeds of 30-45 miles per hour. On Cape Cod this system would consist of 28A in Bourne, Route 28 from Falmouth to Orleans and Route 6A from the Sagamore Bridge to Orleans. It should also include a short loop to tie Wellfleet into Route 6 and Route 6A in Truro and Provincetown. The system should also include a connector between Otis Air Force Base and the Falmouth business district. ★
expressway

This major arterial street system should also incorporate a number of connectors between the north and south shores of the mid Cape and upper Cape. These connectors would connect 6A on the north shore and Route 28 on the south shore. They would include existing Route 151, 130, 149, 132, Willow Street, 134, 137 and Union Street. The net effect is to produce a series of lateral roads connecting the expressway system to the major arterial system, from the Canal to Orleans. North of Orleans there is not sufficient area or development depth to justify the need for lateral arterial streets. } arterial

Minor Arterials and Collectors - At a regional scale this category of functional classification may be appropriate to identify but is difficult to depict as a unified system. In many cases sections of minor arterial roadway do not necessarily reflect a regional orientation, and therefore these roads have little significance beyond an individual community. In some cases roads which are classified as minor arterials do connect points in adjoining communities and serve more than one town. When this occurs it is very important that neighboring communities coordinate highway efforts to maintain road continuity especially in terms of design standards.

The state DPW's proposed administrative classification system makes a distinction between minor arterials and collectors. Roads classified as minor-local have been subdivided into two categories. One is comparable to minor arterials while the other category in the state's administrative classification is more on the order of collector streets. The basic difference between these two types of minor-local roads is in terms of operating design standards, not traffic volume. The traffic volumes normally found on minor arterials or collectors is often of the same magnitude, but higher operating speeds should be attainable on the minor arterial streets. In view of the state DPW's attempt to make this distinction, it is appropriate to also make this distinction on the functional classification. One practical reason for this is that minor arterial roads frequently cross town boundaries and intercommunity coordination is necessary if roadways are to be developed and maintained as continuous entities.

Local Roads - The remainder of roads on the Cape containing the bulk of road mileage in the region serve abutting properties and small traffic generators. In terms of design, traffic volumes to be served are light, traffic operates at a low rate of speed and construction standards are usually low. No truck traffic is expected on local roads except for small delivery vans. Included in this category would be the numerous private roads which serve residential areas although they are not the responsibility of the communities.

In addition to these classifications there is one other type of classification which might be considered on the Cape. This is the "scenic loop". These roadways have, over a period of time, become popular attractions for motorists sightseeing on the Cape. One of the reasons for designating certain roads as scenic loops would be to identify them as sections of roadway whose scenic value should be maintained under any conditions. (Nearly all of the Cape's roads should be maintained in terms of their

scenic and visual amenities.) The purpose of establishing scenic loops as a street classification would be to identify local, collector and minor arterials whose aesthetic qualities are especially attractive.

There are a limited number of roads on the Cape which would fall into the category of a scenic loop. Among these are the Provinceland Road in Provincetown, Panet Road in Truro, Oceanview Drive in Wellfleet, the Loop in Chatham, and Deach Road in Falmouth.

C. ADMINISTRATIVE CLASSIFICATION

The administrative classification as proposed by the state DPW is reasonably compatible with the proposed functional classification. Routes 28 and 6 are designated as state primary (federal-aid primary). Most of the routes which are classified as major arterials appear in the state's classification as state secondary (federal-aid secondary).

The only major difference between the functional classification and the administrative classification proposed by the PDW is Route 28 between Falmouth and Yarmouth. The administrative proposal is that this road be considered a federal aid primary route subject to the same funding and design criteria as Routes 6 and 28 from the Bourne Bridge to Falmouth. Functionally, however, this section of Route 28 serves on-Cape traffic almost exclusively while the other routes serve a different type of traffic. In terms of funding possibilities, it is a good idea to keep this section of Route 28 (from Falmouth to Yarmouth) on the federal aid system although in terms of design standards it should be on the secondary system. There is little difference in funding procedures between federal aid primary and secondary highways.

D. IMPLICATIONS OF CLASSIFICATION

Adoption or approval of street classification does not change the physical street and highway system at all. Designating a route as a major arterial does not require that the route be immediately reconstructed to meet minimum standards or that the traffic volumes on that roadway will increase. The purpose of a classification is to provide a formal guideline for design purposes if and when a roadway is reconstructed or relocated. Furthermore, the functional classification of a roadway may have some effect upon land uses which are permitted adjacent to it. For example, a residential development adjacent to a major arterial might better be served by a single collector street which intersects with the major arterial than to have a series of local streets or driveways intersecting with the major arterial. The results of the latter, for example, would be less desirable from the standpoint of people living in the residential area as well as being less desirable for the region because frequent intersections of local streets and driveways reduce roadway capacity and increase the pressures for new roadway improvements.

The effect of a functional or administrative classification may even be less significant for the Cape than for other areas. Although traffic volumes on the Cape have been growing rapidly over the last several years, total volumes are still quite low and there are few places where traffic volumes approach or exceed roadway capacity. The administrative classification is important because it assigns the legal responsibility for roadway improvement and maintenance. This can be the key factor in developing a regional highway system since unified control of continuous roadways is necessary for capital programming, design continuity and maintenance.

IV: MAJOR FUTURE HIGHWAY ISSUES

A. INCREASED CAPACITY FOR ROUTE 28

Unlike Route 6, where the traffic function is evident and clear-cut, Route 28 has a variety of functions, on the whole is more heavily used than Route 6 and, in terms of attempting to provide additional traffic capacity, presents a much more difficult problem. From the Bourne Bridge south to about Brick Kiln Road, Route 28 functions as an expressway. As it approaches Falmouth Center, it abruptly becomes a two-lane business district street with parking at the curb, a mixture of local and through traffic and heavy pedestrian movements all of which cause reductions in traffic capacity. The net result is almost continuous traffic congestion during the summertime. This is the principal route for traffic headed for Woods Hole and the Islands and for the heavily developed south shore residential areas of Falmouth. Although there are some alternative routes which knowledgeable local people use during high traffic periods, the alternatives are quite limited and it is virtually impossible to reach the south shore without encountering some congestion on Route 28. East of Falmouth, through Teaticket and Waquoit, the character of Route 28 is significantly different than it is north of Falmouth. In this area, Route 28 serves as a collector for several lateral streets such as Davisville Road, Central Avenue, Seacoast Boulevard and Acapesket Road. People living on or off of these streets have no alternative because of the topography but to use Route 28 no matter where they are going. In addition, the route has two other significant uses in this area. It provides access to a number of large, fairly new, commercial establishments serving Falmouth and Mashpee, including Otis Air Force Base. These complicate the traffic picture by generating large volumes of traffic most of which turns into and off of Route 28 within a relatively short distance. Secondly, the road is also the only connector between Cape Cod's two largest communities-Falmouth and Hyannis. Longer distance travelers, interested in traveling at a higher rate of speed, find this section of road frustrating and dangerous. For the automobile sightseer, Route 28 contains a wide variety of stores which cater to tourists. It also has several miles of scenic quality, while providing service between and through most of the Cape's communities.

Rte. 28 changes abruptly

The net result of all these factors is a situation which will require remedial action. The Massachusetts Department of Public Works, at the request of Falmouth officials, is in the process of studying a by-pass of Route 28 through the construction of a new route between Brick Kiln Road near its intersection with Sandwich Road and Pinetree Corner. This by-pass would resolve a problem which has developed along this section of Route 28 in recent years, but would leave untouched the problem of the Falmouth central area.

Route 28 through Mashpee and as far as Centerville in Barnstable is usually free of congestion due to the absence of dense residential areas, the lack of commercial development, and traffic volumes lower than most other portions of the route. However, in Hyannis, especially east of the airport rotary, and in Yarmouth, the situation on Route 28 is critical. Virtually continuous strip commercial development between the rotary and Bass River combined with some of the densest residential development on Cape Cod combine to create a traffic jam which lasts from July 4th to Labor Day. During the summertime, this section of Route 28 is probably one of the busiest non-express roads in the state. Traffic volumes of 40,000 vehicles per day have been reported at different places along Route 28 in Yarmouth.

Since Rte. 28 is critical in Yarmouth

The Town of Yarmouth has considered two alternatives for traffic relief. One is to provide an alternate route north of Route 28 to serve existing residential development and to provide an overflow valve for east-west traffic movement, particularly for trips to Hyannis. The Town is in the process of developing such a route with some control of access to preserve good traffic flow characteristics. A second proposal for Yarmouth concerns the development of a new route along the south shore. This route would not only be expensive because of the numerous inlets and rivers that have to be crossed, but could be aesthetically quite damaging to nearby residences. Furthermore, there is some question as to the need for a through route in this area. Route 6 with its high capacity and lack of congestion (most of the time) even during the summertime is conveniently located to serve longer distance mid-Cape trips between Chatham and Hyannis.

In Harwich traffic conditions are slightly less severe than in Yarmouth because Lower County Road provides an alternate continuous route along the south shore as far east as Harwichport. Furthermore, Route 28 in Harwich is less intensively developed, serves a lower density of residential development and, therefore, has lower traffic volumes.

Along the intermediate stretch of Route 28 between Harwich and Chatham the situation is tolerable. The Town of Chatham is not subjected to any major thrust of through traffic. The land area of the Town juts out into the water and lies southeast by some distance of the mainstream of Cape Cod traffic. The only "through" numbered route in the Town is Route 28. From Route 137 in South Chatham, it serves the primary feeder route from the Mid-Cape Highway to Chatham's central area. Some of the narrowest sections of Route 28, however, are in Chatham. From a traffic standpoint, there is some validity in redesignating other routes as Route 28; for example, Route 39 between South Chatham and South Orleans is a much more logical route in terms of providing continuity for longer distance trips. This might have the effect of removing some "route followers" from the center of Chatham, but otherwise the effect of this change would not be felt. Despite its narrow roads which cause traffic back-ups in the summertime, the town is relatively free of the problems faced on Route 28 in Barnstable and Yarmouth.

Between Chatham and Orleans, Route 28 has more serious problems because of its multiple function. It is the only route between these two towns, but at the same time serves some heavy concentrations of commercial development as well as residential streets which have no alternative but to use Route 28. Between South Orleans and Orleans, there is no way of avoiding Route 28 for through or local travel.

Although there is congestion on Route 28 in this area, it is not continuous throughout the summer and the section of road is less critical than other sections. Also, between Pleasant Bay and Orleans there is very little development immediately adjacent to the road, and additional capacity can be easily obtained almost within the existing right-of-way. One problem in this area is that the road passes through one of the hilliest parts of Cape Cod and as a result, the road contains a number of points where sight distance is limited because of horizontal or vertical curvature. The heavy traffic volumes coupled with minimal design such as short sight distances at intersections create a situation which should be improved.

In summary, Route 28 presents a mixed bag of problems. Nowhere along the route is the traffic volume so low that there are no traffic problems. In only two sections, between Mashpee and Barnstable and between Harwich and Chatham, is the situation such that improvements are not needed immediately. In the center of Falmouth and between Hyannis and Harwich, there is a definite need to improve traffic conditions now. The situation in both areas must be carefully studied in order to determine what type of traffic improvements would best serve the region.

One possibility for alleviating traffic conditions along Route 28 which has, for the most part, largely been overlooked by local communities, is the systematic improvement of bottleneck situations. In a number of locations, the installations of traffic signals, left turn lanes, channelization, and other traffic operation techniques, would greatly improve traffic operating conditions. For the most part, these types of improvements are low-cost, rarely involve the acquisition of buildings for highway purposes, and are comparatively easy to implement. In some situations, short connections to little used alternative routes would improve their attraction and would produce additional traffic capacity with a minimum of impact on the communities. This effort should have first priority for improving conditions on Route 28, even on those sections of roadway where by-pass construction is imminent. Even if traffic volumes go down for a short period of time, they will most likely reach or even exceed existing volumes after a few years.

B. COMPLETION OF ROUTE 6 EXPRESSWAY

The development of Route 6 has perhaps been a yardstick of growth on Cape Cod. In the mid-1940's what is now Route 6A was the only highway between the Sagamore Bridge and Provincetown. By 1950, however, a new Route 6 had been constructed as a four-lane divided highway between the rotary at the east end of the Sagamore Bridge and the Barnstable rotary at Route 132 which provided access to Hyannis and the south shore of the middle Cape. By 1956 the route had been extended into Dennis as far as Route 134 as a two-lane limited access undivided roadway with provisions for widening to a four-lane divided highway. Interchanges were designed to be useful when the road was enlarged to four lanes. By 1958 the two-lane section had been extended as far as Orleans. 1940
1950
1956
1958
vs.
1960
6

At the tip of Cape Cod work also was going on to improve Route 6 because of the heavy summertime traffic and in particular the low capacity of Route 6 which served several miles of waterfront cottage development. By 1955 Route 6 had been bypassed by a four-lane roadway between North Truro and the tip of Provincetown. By 1968 five miles of two lane roadway east of the Barnstable rotary was converted to four lanes. The rotary was replaced with a new interchange and the road eastward for a distance of 5 miles was provided with a new roadway for eastbound traffic.

As of 1969, Route 6 is a four-lane divided highway from the Sagamore Bridge to a point east of Willow Street in Yarmouth. Work on a continuation of widening Route 6 eastward will begin this year from the existing four-lane divided section in Yarmouth to Route 134 in Dennis. By 1975 the state DPW plans to have the entire length of Route 6 from the Sagamore Bridge to the Eastham rotary a full four-lane limited access highway.

One of the most important pieces of unfinished highway business is the completion of a four-lane divided highway from Eastham through Truro to link the existing sections of Route 6 expressway. Route 6 through Eastham, Wellfleet and most of Truro has become an increasingly important section of roadway because of the National Seashore Park. This development has had the effect of drawing traffic to the lower Cape that might otherwise not travel as far if beaches, resorts and other tourist facilities were all that motorists were seeking. Aside from this factor, the road pattern on Cape Cod makes Route 6 north of the Eastham rotary particularly important. In Orleans, Routes 6, 6A, 28 all converge to become one highway which serves not only traffic destined for the lower Cape but local access needs as well. There are no alternate roads to bypass Route 6 in Wellfleet and Truro. In Eastham, while there are parallel routes, their design and the abutting land uses make them undesirable as through traffic route alternatives. Seashore
draws
traffic
from
other
roads
Eastham

Based on the existing highway construction timetable, the missing link between the four-lane sections both north and south cannot be expected prior to 1975. Even though the construction of this roadway is several years away, there has been a great deal of interest centered on its location and design. The DPW has expressed some interest in its design and has "flown" the area to obtain aerial photography to assist in the preparation of preliminary location plans. The rapid pace of recent development as well as the abandonment of the railroad line with the possibility that part of it could be used as a location for the new highway are two reasons for the current interest. The Cape Cod Seashore administrators are also interested in the future location of Route 6 through Eastham, Wellfleet and Truro because of its potential impact on the design of the park and the location of its facilities as well as the impact of the route on its use. The town of Eastham has also expressed concern over the location of a new route because of its obvious impact on the town. Eastham has had its planning consultants make a study of potential routes for the new highway.

Despite the strong interest of a variety of governmental agencies, there has been little coordination among them. Yet the need for some type of coordination and for an early determination of the route, including advance land acquisition, is clearly evident. The individual communities are perhaps in the poorest position to design the entire section of roadway since no one community can speak for the others; furthermore, the DPW rarely foregoes its responsibility for planning and designing state highways. The National Park Service which administers the Cape Cod National Seashore has a strong interest in the location of the route not only in Truro where the route would pass through Seashore property but also in Wellfleet and Eastham where the location would have a definite impact on the operation of the Seashore. The National Park Service, because it is a federal agency must give its approval to any taking of its land for highway purposes by a state agency. Therefore, the National Park Service will have a controlling voice in the location of the route where it passes through National Seashore property. Although the Park Service does not have official jurisdiction outside of the park, it could have a great deal of influence in the location and design of the roadway since another federal agency, the Bureau of Public Roads (Department of Transportation), must give approval of the location and design. It is quite possible that if the National Park Service is in favor of a specific route, its influence with another federal agency in Washington would be a major factor in its location.

This report is primarily an inventory and alternative Route 6 locations have not been studied. However, in assessing the planning situation it is evident that the Regional Planning Commission should be the agency to coordinate the efforts of local, state and federal agencies working on the problem. It may be a tall order for a regional agency with no operational authority to coordinate the efforts of independent and autonomous local, state and federal officials, nevertheless it is a task which the region commission can best handle. In this regard the following steps are suggested as a way of coordinating the efforts of these agencies and of obtaining a location for the route before the task is complicated by further land developments:

1. Sponsor a conference of local, federal and state officials to air the various proposals that have been made to date. It would be valuable if each of the individual towns, the National Park Service and the state DPW were to attend such a meeting and present their preliminary thinking on the route location.

other
national
regional
plan
commission
to coordinate
DPW
state
locations

2. The state DPW should be assigned the responsibility of developing location alternatives based on information obtained from the various agencies. In the process, a technical committee should be established consisting of federal, state, regional and local officials to meet regularly with the DPW during the location analysis phase.
3. A public hearing should be held to present the location alternatives.
4. Based on the public reaction, a location should be chosen by the DPW with the approval of the technical committee. This should be analyzed in greater detail and presented at a second public hearing.
5. Assuming a general consensus on the plan, advance acquisition should be made by the DPW. As an alternate, the individual towns could adopt either zoning or in some other way protect the right-of-way until it is needed.

The entire process should take about a year to complete. The state DPW would not relinquish its prerogatives in locating and designing highways but the creation of a technical committee would permit other agencies to protect their legitimate interests in the highway location. The two hearings procedure has recently been adopted by the Department of Transportation so that this is in conformance with approved practice. Unless action is taken in the near future to coordinate the thoughts of various agencies in determining the location of the route, the task will inevitably be more difficult as time goes on and the problems which will result from construction of the route will be more severe.

Regional responsibility for highway planning has been widely accepted and adopted by both federal and state agencies. Most transportation planning conducted during the past ten years has been at the regional level. Furthermore, a Regional Planning Commission has no specific interests in its region other than to find a route which best satisfies all the parties concerned. Despite the logic of this, it is unlikely that the Regional Planning Commission could obtain money from its regular sources of planning funds to conduct a highway location analysis. While highway planning has become a matter of state-regional coordination, highway location responsibilities are still vested in the state highway agencies. The recommended procedure attempts to maintain the status quo in terms of jurisdictional responsibilities while at the same time providing a framework for coordination between the agencies and communities who would be most effected by the new highway.

C. THE THIRD BRIDGE

The construction of a third bridge over the Cape Cod Canal has occasionally been mentioned as a solution to Cape Cod's traffic problems. Over the past 20 years improvements to Routes 6 and 28 on the Cape and to Routes 3 and 6 off the Cape have had their impact on the existing Cape Cod Canal bridges. The rotary approaches to both bridges and the narrow four-lane cross section of the Sagamore and Bourne bridges do in fact create a bottle-neck during periods of peak traffic flow onto and from the Cape particularly at the Sagamore Bridge. The construction of a third bridge has been called an

obvious solution to an existing bottleneck.

However, there are a number of factors which suggest that at least for the moment a third bridge is not necessary. Furthermore, the problems which could be created by another bridge should be thoroughly studied before any commitment is made. At the present time the state Department of Public Works is not considering the construction of a third bridge. The DPW expects that improvements to Route 25 connecting to the Bourne Bridge will result in increased utilization of that bridge and relieve the pressure for the construction of a third bridge for a few years. At the present time the Bourne Bridge is not being used to full capacity partly because of the off-Cape highway situation. Highway improvements are expected to help balance the traffic volumes between the two existing bridges. The 1968 summer average daily traffic on the Bourne Bridge (based on 1966 AADT projected to 1968) was 27,000 vehicles per day and on the Sagamore Bridge, 37,000 vehicles per day. It is estimated that at the Sagamore and Bourne bridges, the traffic rotaries and the 40 foot pavement width probably reduce the rated capacity of the bridges to about 30,000 vehicles per day. The rated capacity of Route 3 north and Route 6 east of the Sagamore Bridge is approximately 45,000 vehicles per day.

After making highway improvements aimed at balancing the traffic volumes on both bridges, the next goal should be to increase the existing capacity of the two bridges. This can be accomplished by elimination of the rotaries and possibly a small but significant widening of the bridge pavement by as little as 4 feet plus a redesign of the granite curb which restricts capacity because of its height. If the capacities of the Bourne and Sagamore bridges were increased to equal the capacity of the four-lane expressways on either side, it would further extend the life of the existing bridges for a period of years. If both the Bourne and Sagamore bridges were to have a highway capacity of 45,000 vehicles per day or a combined capacity of 90,000, it would take at least 5 years for the practical capacity of the bridges to be reached if an average annual increase in traffic volumes of 10 percent is assumed. Operating above practical capacity, a frequent occurrence on many of Cape Cod's highways in the summertime, the life of the existing bridges would be even further extended. If the bridges handle volumes about 30 percent over their practical capacity, which the Sagamore Bridge does now, an additional five years of useful, comparatively trouble-free life could be obtained from the bridges. Thus it is quite probable that the Bourne and Sagamore bridges can serve traffic until 1980. This does not mean that congestion would never occur. For people traveling in the peak directions on a Friday night or Sunday night during the height of the summer, it is quite possible that they would encounter some congestion.

If a third bridge is built merely to provide capacity for peak overload traffic, Cape Cod officials could very easily endorse such a proposal. However, the implications of a third bridge are much broader. The same bridge which would relieve peak hour congestion in the summertime would also permit an additional 45,000 vehicles per day to cross the Canal. The impact of this additional traffic on existing roads could be severe, depending on a variety of factors. Will the additional cars arrive only during weekends? Will they be destined for nearby beaches or will they be destined for the lower Cape? Will the additional traffic contain day-trippers, weekenders, campers, summer residents, visitors to the National Seashore or even perhaps commuters from Cape Cod to Providence and Boston? Any endorsement for a third bridge should be withheld until its impact on Cape Cod's highway system and regional development are carefully evaluated. It is possible that with careful land-use and highway planning additional traffic can be absorbed on Cape Cod.

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APPENDIX

Accident Analysis

ACCIDENT STATISTICS

In terms of long range transportation planning, traffic accident records and analysis have a limited value: They are indicative of current operational deficiencies on existing roadways. While they may give an indication of needed improvements as a longer term parameter they cannot be projected for planning purposes.

Another problem with accident records is that they often show up problems that are not of a planning nature. For example, obvious defects in roadway design will result in a high accident rate although the road may be adequate as a traffic carrier. A high accident rate therefore could be reduced by operational improvements instead of a new by-pass. Regional transportation planning is not the best approach to the problem of traffic safety although it is a legitimate regional concern. As noted elsewhere, existing traffic congestion (such as on route 28 in Yarmouth) can be better attacked by operational studies of specific sections of highway.

In order to provide the Commission with accidents figures that may be of value in mounting a regional effort to reduce highway accident rates this section of the report analyzes accident data made available by the Mass. Registry of Motor Vehicles and the Mass. Department of Public Works. Accident records at the town level are rarely useful for statistical analysis and they are non-existent at the County level. One reason for this is that for many years accident records had only legal value. They were useful as evidence in court cases involving legal actions. Their use as a basis for identifying and correcting highway design deficiencies has been a fairly recent one. Nevertheless accident record keeping is still at an infantile state nationally as well as in Massachusetts, although efforts are being made to improve the system.

Table 1 shows a summary of accident statistics on Cape Cod for the individual towns for a ten year period from 1958 to 1967. These figures are town-wide and do not indicate where the accidents occurred. For the Cape as a whole, the number of accidents increased by a little over 100% during this period.

Falmouth stands out in terms of the total number of fatal accidents. Although Barnstable and Falmouth have comparable total accident figures, Falmouth fatalities should be a cause for serious concern. The reason for Falmouth's poor safety record cannot be determined from these figures: however, they indicate that a major effort to explain the high number of fatalities is necessary in order to institute an effective remedial campaign.

The Lower Cape communities have the fewest total number of fatalities and accidents - an indication of their lower traffic volumes more than anything else. Provincetown has had only four fatal accidents during the ten year period while Truro has had ten, Wellfleet, six and Eastham, five. Provincetown's better record may stem from the existence of Routes 6 and 6A which serve to separate different types of traffic, local and through. Different types of traffic operating on the same road are a known cause of accidents. One obvious justification for the need for a new Route 6 through Eastham, Wellfleet and Truro is to separate through and local traffic. (It should be noted that it has been assumed that most accidents reported have occurred on Route 6.)

It is not possible to reach any firm conclusions relative to the comparative safety of Cape Cod highways. Based on the annual growth rate of the number of accidents versus the annual growth rate of traffic volumes, it appears that in terms of total vehicle miles, the accident rate is declining. Part of this decline is caused by increased congestion which generally results in fewer accidents and, in particular, fewer fatalities per vehicle mile, simply because traffic cannot move fast. As the report notes, Route 6 on the lower Cape is potentially one of the most dangerous sections of road because increased traffic volumes have not materially reduced the rate of speed. Thus, while on the basis of traffic congestion alone existing Route 6 may have some life left in it, from a safety standpoint, it represents a serious problem.

TABLE 5 - SELECTED ACCIDENT STATISTICS BY TOWN, 1958-1967, BARNSTABLE COUNTY, MASS.

TOWN		Y	E	A	R					
Barnstable	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Fatal	1	2	2	1	3	1	8	2	3	4
Pers.Injury	97	123	131	133	175	188	217	231	252	280
Prop.Damage	63	53	62	73	81	93	106	142	169	199
Bourne										
Fatal	1	1	2	3	2	0	0	2	2	3
Pers.Injury	105	92	111	92	101	99	131	137	126	143
Prop.Damage	41	57	53	72	57	63	69	110	97	115
Brewster										
Fatal	1	0	0	1	0	2	0	1	3	1
Pers.Injury	5	6	7	10	4	3	8	23	28	24
Prop.Damage	5	0	3	5	8	5	17	23	15	23
Chatham										
Fatal	1	0	1	0	1	0	0	1	1	0
Pers.Injury	14	18	22	20	26	29	33	39	34	38
Prop.Damage	9	6	9	21	22	15	23	30	30	53

TABLE 5 - SELECTED ACCIDENT STATISTICS BY TOWN, 1958-1967, BARNSTABLE COUNTY, MASS.
(CONTINUED)

TOWN	Y E A R									
Dennis	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Fatal	0	0	1	1	0	2	1	3	4	2
Pers.Injury	31	29	46	40	47	61	57	70	99	103
Prop.Damage	13	10	21	28	19	29	33	58	63	94
Eastham										
Fatal	0	0	0	0	1	3	0	1	0	0
Pers.Injury	10	9	10	12	18	17	19	35	29	29
Prop.Damage	10	5	6	4	9	11	6	17	26	28
Falmouth										
Fatal	3	2	7	4	5	4	2	4	9	5
Pers.Injury	56	102	110	123	122	151	164	188	250	203
Prop. Damage	39	40	64	82	63	71	59	115	148	180
Harwich										
Fatal	0	0	0	2	2	1	2	0	0	0
Pers.Injury	30	28	33	42	44	32	51	60	72	64
Prop.Damage	24	21	26	40	42	24	41	34	42	73
Mashpee										
Fatal	0	1	0	0	1	2	3	1	0	1
Pers.Injury	5	4	13	12	16	5	11	19	25	33
Prop.Damage	5	2	5	11	5	4	8	14	9	21
Orleans										
Fatal	2	0	0	1	0	0	0	1	2	0
Pers.Injury	21	18	20	16	22	17	28	41	51	46
Prop. Damage	7	7	10	14	29	14	14	25	29	32

TABLE 5 - SELECTED ACCIDENT STATISTICS BY TOWN, 1958-1967, BARNSTABLE COUNTY, MASS.
(CONTINUED)

TOWN	Y E A R									
Provincetown	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Fatal	0	2	1	0	0	0	0	1	0	0
Pers.Injury	25	22	19	29	30	33	36	57	41	57
Prop.Damage	16	6	11	20	27	36	32	35	41	149
Sandwich										
Fatal	0	1	1	0	1	2	1	0	2	0
Pers.Injury	27	20	21	22	31	29	37	35	30	43
Prop.Damage	23	14	16	14	19	16	23	31	22	33
Truro										
Fatal	0	2	1	0	2	0	1	1	1	2
Pers.Injury	11	7	13	10	6	8	18	29	18	16
Prop.Damage	7	7	7	8	7	4	11	16	17	18
Wellfleet										
Fatal	0	0	2	1	1	0	0	1	1	0
Pers.Injury	3	10	11	6	4	9	17	23	31	10
Prop.Damage	7	1	1	5	4	1	11	16	18	26
Yarmouth										
Fatal	2	0	1	0	3	2	4	0	1	2
Pers.Injury	64	73	72	88	106	102	123	154	163	146
Prop.Damage	32	42	47	48	65	84	70	122	115	141
Total Cape										
Fatal	11	11	19	14	22	19	22	19	29	20
Non-Fatal	544	561	639	655	752	783	950	1161	1249	1235
Prop.Damage	301	271	341	445	457	470	523	788	841	1085

Source: Mass. Registry of Motor Vehicles, Statisticians Office, Annual Tabulation
Selected from Statistical Analyses.